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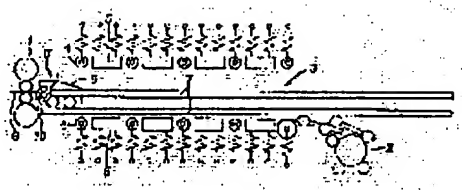
(54) STRIP STEEL HOT ROLLING EQUIPMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To uniformize cooling rate in the width direction of a strip by retracting pinch rolls and a cooling water injecting device during passing a strip front end part restricting device in a hot rolling equipment.
SOLUTION: The front end part of the strip 6 come out from a finish rolling mill 1 is grasped with the strip front end part restricting device 8 and run toward a down coiler 2 synchronized with a rolling speed. The pair of pinch rolls attchably/detachably shiftable with the strip 6 and cooling water injection devices retracted in the vertical direction accompanied with the passing of the strip front end part restricting device 8 are shifted so as to approach vertically each surface of the strip 6 in order. The pinch rolls 4 are attached on vertically each surface of the strip 6 to keep the tension of the strip 6 in a specified range. Further, after passing the strip front end part restricting device 8, rapid cooling to the whole surface of the strip 6 can be executed while applying water pressure from the cooling water injection device 5. By this constitution, the length of a cooling line can be reduced and a scale layer on the surface of the strip 6 can be reduced.



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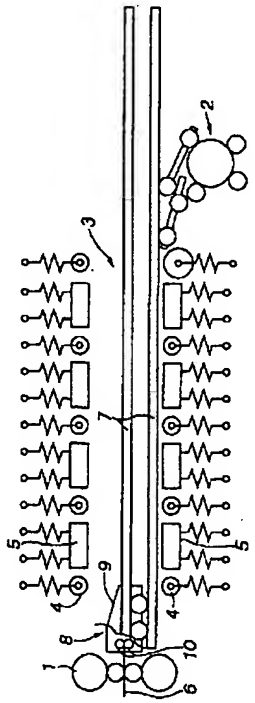
(54)【発明の名称】熱間帯鋼圧延設備

(57)【要約】

【課題】　板幅方向についての冷却度を均一化し得るように改良された熱間帯鋼圧延設備を提供する。

【解決手段】　仕上圧延機及びコイラと、これら仕上圧延機とコイラとの間に延設されたストリップ冷却ラインとを有する熱間帯鋼圧延設備に於いて、ストリップの先端を挟持してストリップに張力を付与しつつ仕上圧延機側からコイラ側へと圧延速度に同期して移動可能なストリップ先端拘束装置をストリップ冷却ライン上に設けると共に、ストリップ冷却ラインの構成を、ストリップ先端拘束装置が通過する間だけストリップ先端拘束装置の進路上から待避可能であり、かつストリップ先端拘束装置が通過した後にストリップの上下両面に接触可能なピンチロールと、ストリップ先端拘束装置が通過する間だけストリップ先端拘束装置の進路上から待避可能であり、かつストリップ先端拘束装置が通過した後にストリップの上下両面に近接可能な面内に噴射口が設けられた冷却水噴射装置とを有するものとする。



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【特許請求の範囲】

【請求項１】　仕上圧延機及びコイラと、前記仕上圧延機と前記コイラとの間に延設されたストリップ冷却ラインとを有する熱間帯鋼圧延設備であって、

ストリップの先端を挟持してストリップに張力を付与しつつ前記仕上圧延機側から前記コイラ側へと圧延速度に同期して移動可能なストリップ先端拘束装置が前記ストリップ冷却ライン上に設けられており、

前記ストリップ冷却ラインは、前記ストリップ先端拘束装置が通過する間だけストリップ先端拘束装置の進路上から待避可能であり、かつストリップ先端拘束装置が通過した後に前記ストリップの上下各面に接触可能なピンチロールと、前記ストリップ先端拘束装置が通過する間だけストリップ先端拘束装置の進路上から待避可能であり、かつストリップ先端拘束装置が通過した後に前記ストリップの上下各面に近接可能な面内に噴射口が設けられた冷却水噴射装置とを有するものであることを特徴とする熱間帯鋼圧延設備。

【請求項２】　前記冷却水噴射装置の水流の向きが、通板方向に概ね沿うことを特徴とする請求項１に記載の熱間帯鋼圧延設備。

【請求項３】　前記冷却水噴射装置の水流の向きが、板幅方向中央側を向く成分を含み、かつ該成分が、板幅方向外側へ行くに従って大きくなることを特徴とする請求項２に記載の熱間帯鋼圧延設備。

【請求項４】　前記冷却水噴射装置のストリップとの対向面に、板幅方向の両側が開放した溝が設けられることを特徴とする請求項１乃至３のいずれか１項に記載の熱間帯鋼圧延設備。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、熱間帯鋼圧延設備（ホットストリップミル）に関するものである。

【０００２】

【従来の技術】熱間帯鋼圧延設備に於いては、仕上圧延機によって所定の板厚にまで圧延されたストリップは、ダウンコイラのマンドレルに巻き取られるまでの間に、仕上圧延機とダウンコイラとの間に設けられたストリップ冷却ラインにより、所定の巻き取り温度にまで冷却される。このストリップ冷却ラインは、数百本の駆動式ローラテーブルからなるランアウトテーブルと、水スプレー式冷却装置または水ラミナー式冷却装置とから構成されており、ランアウトテーブルのローラ間から噴射される冷却水により、ランアウトテーブル上を搬送されるストリップの下面を冷却し、ランアウトテーブルの上方から噴射される冷却水により、ストリップの上面を冷却するようになっている。

【０００３】

【発明が解決しようとする課題】ところで、上記の如き水スプレー式冷却装置または水ラミナー式冷却装置の場合、ストリップの上面を流れた冷却水の殆どがストリップの側端から流れ落ちる。そのため、中央部は冷却水の流れがよどみがちとなるのに比して側端部は常に新水に触れることとなるので、板幅方向についての冷却度が不均一になりがちであった。

【０００４】本発明は、このような従来技術に課せられた問題点を解消し、板幅方向についての冷却度を均一化し得るように改良された熱間帯鋼圧延設備を提供することを目的に案出されたものである。

【０００５】

【課題を解決するための手段】このような目的を果たすために、本発明に於いては、仕上圧延機及びコイラと、これら仕上圧延機とコイラとの間に延設されたストリップ冷却ラインとを有する熱間帯鋼圧延設備に於いて、ストリップの先端を挟持してストリップに張力を付与しつつ仕上圧延機側からコイラ側へと圧延速度に同期して移動可能なストリップ先端拘束装置をストリップ冷却ライン上に設けると共に、ストリップ冷却ラインの構成を、ストリップ先端拘束装置が通過する間だけストリップ先端拘束装置の進路上から待避可能であり、かつストリップ先端拘束装置が通過した後にストリップの上下各面に接触可能なピンチロールと、ストリップ先端拘束装置が通過する間だけストリップ先端拘束装置の進路上から待避可能であり、かつストリップ先端拘束装置が通過した後にストリップの上下各面に近接可能な面内に噴射口が設けられた冷却水噴射装置とを有するものとした。

【０００６】そして、冷却水噴射装置の水流は、通板方向に概ね沿わせ、特に、板幅方向外側の噴射口の水流ほど板幅方向中央側を向く成分が大きくなるようにした。さらに、冷却水噴射装置のストリップとの対向面に、板幅方向の両側が開放した溝を設けるものとした。

【０００７】

【発明の実施の形態】以下に添付の図面を参照して本発明の構成を詳細に説明する。

【０００８】図１並びに図２は、本発明に基づく熱間帯鋼圧延設備に於ける仕上圧延機１の最終スタンドと、ダウンコイラ２と、これらの間に延設されたストリップ冷却ライン３とを示している。ストリップ冷却ライン３は、通板方向について適宜な間隔を開けて列設された上下に対をなす多数のピンチロール４及び冷却水噴射装置５からなっている。これらのピンチロール４と冷却水噴射装置５とは、通板方向について交互に配置されている。

【０００９】各ピンチロール４は、上下のロール対からなり、各ロールがそれぞれ上下に接離移動可能に支持されている。各ピンチロール４は、仕上圧延機１から送出されるストリップ６の上下両面を所定の押圧力をもって挟み込むと共に、各々が駆動力を与えられ、かつ回転速度が自由に制御されるようになっている。そして冷却水噴射装置５は、ピンチロール４と同様に、上下に対をな

す冷却水噴射装置からなり、各冷却水噴射装置５が、ストリップ６の上下各面に接離移動可能に支持されている。この冷却水噴射装置５のストリップ６との対向面には、複数の冷却水ノズルが設けられており、ストリップ６の上下各面に冷却水を吹きかけることができるようになっている。

【００１０】ストリップ冷却ライン３には、ガイドレール７が通板方向に沿って延設されている。このガイドレール７には、仕上圧延機１から送出されるストリップ６の先端を把持した状態で走行するストリップ先端拘束装置８が載置されている。ストリップ先端拘束装置８は、上下のガイドレール７に車輪が規制されて浮き上がりが防止されると共に、例えば、ガイドレールと平行に延設されたラックギヤに噛合するピニオンギヤで駆動される走行台車９と、仕上圧延機１から送出されるストリップ６の先端を上下から把持する把持ロール１０とを備えている。

【００１１】前記の冷却水噴射装置５は、図３及び図４に示したように、ストリップ６との対向面が平面をなしており、冷却水ノズル１３は、この平面に多数凹設された窪み１４内に開口している。そして冷却水ノズル１３の噴射方向は、通板方向に概ね沿っており、図５に矢印Ｆで示したように、ストリップ６の送出方向の上流側或いは下流側のいずれかの方向へ、全ての水流の向きが平行に揃えられているか、或いは、図６に同じく矢印Ｆで示したように、外側のものほど板幅方向の中央側へ向けられている。特に、全ノズルの水流Ｆを通板方向に平行とせずに、外側のノズルの水流ほど板の内側を向く成分を大きく与えることにより、ストリップ６の側端から早期に冷却水が流出することを抑制し、ストリップ６の側端部のみが新水に触れて過冷却となることを防止し得る。

【００１２】冷却水噴射装置５のストリップ６との対向面には、板幅方向に沿う溝１５が凹設されている。この溝１５により、各冷却水ノズル１３から噴出した新水は、把持ロール１０に干渉せずに早期にかつ平均して排出されるので、冷却水の流量を増大することが可能となり、ストリップ６の冷却速度を高めることができる。さらにこれにより、冷却水噴射装置５とストリップ６との間の冷却水圧力の板幅方向についての勾配を緩和して溝１５以外の冷却水圧の高い部分に於ける板幅方向の流れを抑制し、板幅方向の冷却むらの発生を防止することができる。なお、この溝１５は、板幅方向に直線的なものばかりでなく、図７に示したように、適宜に湾曲したものであっても良い。またこのような溝１５によらずに、図８に示す如く、冷却水噴射装置５の通板方向についての分割単位を小さくし、各分割単位間に適宜な隙間Ｇを開け、この隙間Ｇから排水するようにしても、冷却速度を高め、かつ冷却むらを無くすのに効果的である。加えて、冷却水ノズル１３の配置についても、要は溝１５で区切られた各セクションの水流バランスの問題であり、規則的な配列に限らず、ランダムな配置であっても良い。

【００１３】次に上記実施例の作動要領について説明する。

【００１４】ストリップ６の先端が仕上圧延機１から送出される以前の状態に於いては、図１に示したように、全てのピンチロール４並びに全ての冷却水噴射装置５が互いに上下に離間した位置に移動して待機している。そしてストリップ先端拘束装置８は、仕上圧延機１の最終スタンドの出口の直近にて、仕上圧延機１からのストリップ６の送出速度よりもやや高い周速度で把持ロール１０を回転させた状態で待機している。

【００１５】ストリップ６の先端が仕上圧延機１から出ると、ストリップ先端拘束装置８は一対の把持ロール１０間にストリップ６の先端を直ちに把持する。それとほぼ同時か、或いはむしろ幾分早めに、ストリップ先端拘束装置８はダウンコイラ２へ向かっての加速を開始し、短時間で仕上圧延機１の圧延速度に同期して走行するようになる。

【００１６】一方、上下両方向に待避していたピンチロール４並びに冷却水噴射装置５の各対は、ストリップ先端拘束装置８の通過に連れて順にストリップ６の上下各面に接近するように移動する。そしてピンチロール４は、ストリップ６の上下各面に接触してストリップ６の張力を常時所定範囲に維持するように、その回転速度が制御される。また冷却水噴射装置５からは、ストリップ６の上下各面に向けて冷却水が吹きかけられる。このようにして、ストリップ６は、常時適切な張力が付与された状態で冷却されるので、冷却後の板形状が大幅に改善される。しかも冷却水噴射装置５もストリップ６の表面に対して接離移動可能なので、ストリップ先端拘束装置８の通過後に冷却水噴射装置５をストリップ６の表面に近接させてストリップの全面に水圧を加えて急速冷却することができることから、冷却ライン長を削減し得る。これに加えて、ストリップ６の表面に発生するスケール厚が小さくなるので、次工程の酸洗いの負荷が軽減される。

【００１７】ストリップ６の先端がダウンコイラ２の入り口に到達したならば、ストリップ先端拘束装置８の把持ロール１０の把持力を解放する。これにより、ストリップ先端拘束装置８はストリップ６から離れてガイドレール７の終端までそのまま走行して停止する。

【００１８】他方、ダウンコイラ２の入り口近傍には、図２に示したように、ストリップ６の先端をダウンコイラ２へと導入するための流体噴射装置１１が設けられている。この流体噴射装置１１から、ストリップ先端拘束装置８からストリップ６が切り離されると同時に、自由になったストリップ６の先端部へ向けて加圧された水、空気、窒素ガスなどを吹き付け、ストリップ６の先端を

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ダウンコイラ2の入り口へと導く。この時、ストリップ6の進行方向の速度成分を噴射流体に与えることにより、ダウンコイラ2の入り口へのストリップ6の流入をより一層円滑化することができる。

【0019】なお、ダウンコイラ2のマンドレルにストリップ6が巻き取られる際には、ピンチロール4にてストリップ6に対するバックテンションを常時加えることにより、ストリップ6は弛みなく均一に巻き取られる。従って、ストリップ冷却ライン3上でのストリップ6の減速が可能となるので、仕上圧延機1に於いてはストリップ尾端の圧延速度を減速する必要がなくなる。

【0020】ストリップ6の尾端がピンチロール4を通過する際に、尾端への拘束力が途切れるために尾端が上下に振れるおそれがあるが、下側に位置する各冷却水噴射装置5に内蔵された電磁吸引装置12により、尾端の安定走行が維持される。そして尾端がダウンコイラ2に到達した際にも、流体噴射装置11からの噴射圧によって尾端を安定させることができるので、ストリップ尾端の搬送速度を大幅に減速する必要がなくなる。

【0021】ところで、1つのコイルが巻き終わったならば、次のストリップの送出に備えて仕上圧延機1の直後の位置へストリップ先端拘束装置8を復帰させねばならないが、この復帰時間はロスタイムとなる。このロスタイムが生じないようにするためには、図9に示すように、ストリップ冷却ライン3に設けられたガイドレール7と平行に戻し専用のガイドレール21を設け、これら2組のガイドレール7・21の始端部と終端部とのそれぞれに、ストリップ先端拘束装置8が載る程度の短尺レール22a・22bを接続可能なようにすると共に、この短尺レール22a・22bが左右に横移動自在なように横行レール23a・23bを設け、2台のストリップ先端拘束装置8を短尺レール22a・22bと共に交互に横移動させるようにすると良い。このようにすれば、一方のストリップ先端拘束装置がガイドレール7上を走行している間に、他方のストリップ先端拘束装置を戻し専用のガイドレール21上を走行させて仕上圧延機1側へ戻し、コイルを巻き終わってピンチロール4と冷却水噴射装置5とが上下に開かれた際に、既に始端側に帰還している他方のストリップ先端拘束装置を始端側の短尺レール22aと共に横移動させてストリップ冷却ライン3のガイドレール7に整合させ、かつストリップ冷却ライン3の終端まで走行した一方のストリップ先端拘束装置を終端側の短尺レール22bと共に横移動させて戻し専用のガイドレール21に整合させることができるので、次のストリップの送出に対する待機状態をロスタイムを生ずることなく実現することができる。

【0022】

【発明の効果】このように本発明によれば、仕上圧延機から送出されるストリップの先端を機械的に拘束したストリップ先端拘束装置が、仕上圧延機の圧延速度に同期して走行するので、冷却時に一定の張力をストリップに与えることができ、しかも冷却水噴射装置をストリップに近接させることで冷却効率を向上し得るので、ストリップの全長に渡って冷却状態が均一化されることとなる。従って、ストリップの品質向上を達成し得る。しかもストリップの全長に渡ってフライングや蛇行の発生を防止し得るので、仕上圧延機の能力に対応して通板速度を高速化できるので、生産性の向上をも達成可能である。

【図面の簡単な説明】

【図1】本発明設備に於けるストリップ冷却ラインへストリップを通板する以前の状態を示す概念的構成図。

【図2】本発明設備に於けるストリップ冷却ラインへストリップを通板した状態を示す概念的構成図。

【図3】冷却水噴射装置のストリップとの対向面の一例を示す概略平面図。

【図4】冷却水噴射装置の部分的な断面図。

【図5】通板方向と水流との関係の一例を示す概念的平面図。

【図6】通板方向と水流との関係の別例を示す概念的平面図。

【図7】冷却水噴射装置のストリップとの対向面の別例を示す概略平面図。

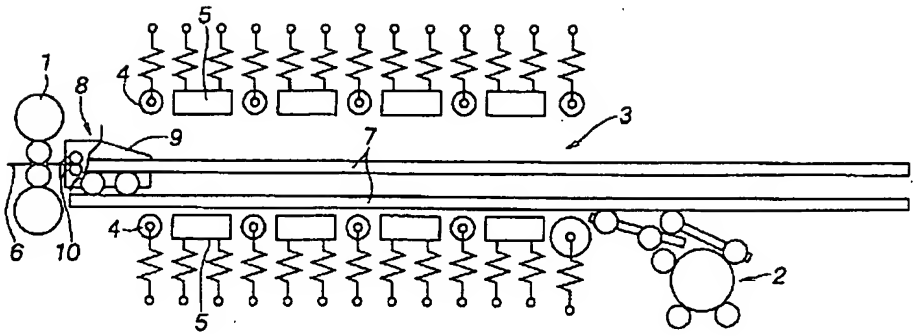
【図8】冷却水噴射装置の別の構成例を示す概念的平面図。

【図9】ストリップ先端拘束装置のガイドレールの配置図。

【符号の説明】

1　仕上圧延機
2　ダウンコイラ
3　ストリップ冷却ライン
4　ピンチロール
5　冷却水噴射装置
6　ストリップ
7　ガイドレール
8　ストリップ先端拘束装置
9　走行台車
10　把持ロール
11　流体噴射装置
12　電磁吸引装置
21　戻し専用ガイドレール
22a・22b　短尺レール
23a・23b　横行レール

【図１】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4
3
9
7
6
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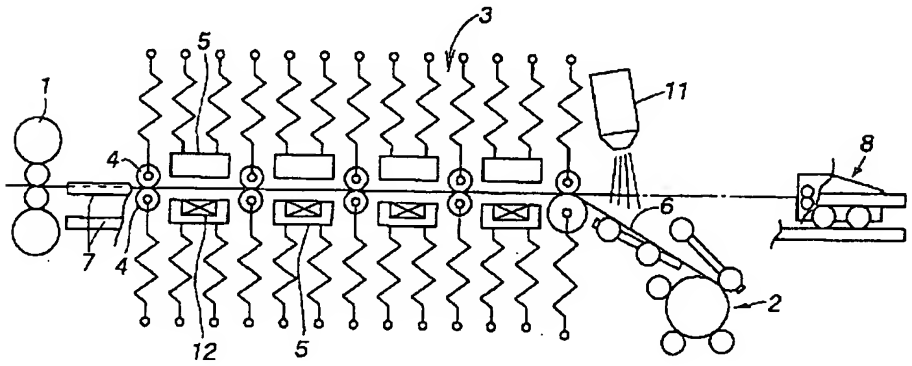
5
2

【図２】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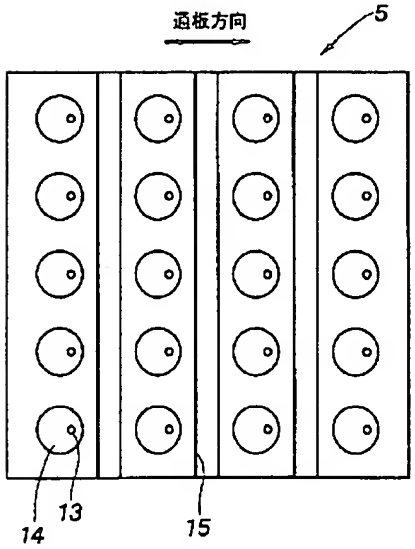
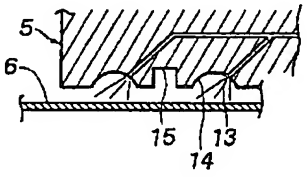
8
4
6
7
4
2
12
5

【図３】


通板方向
5
14
13
15

【図４】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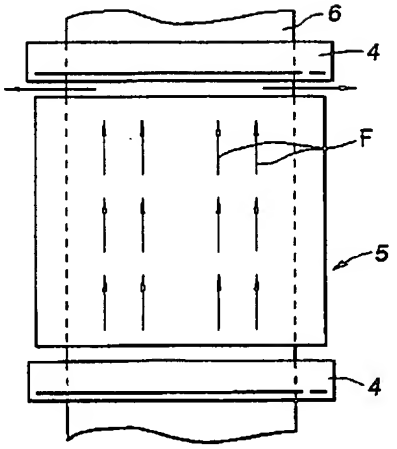
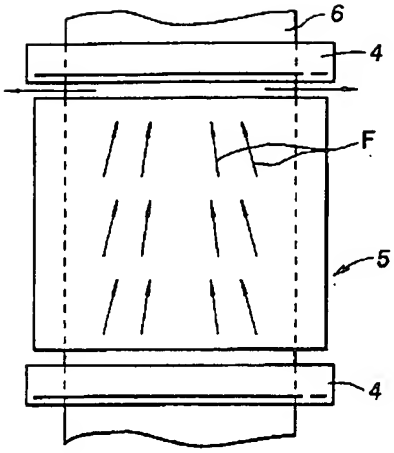
6
15
13
14

【図５】


6
4
F
5
4

【図6】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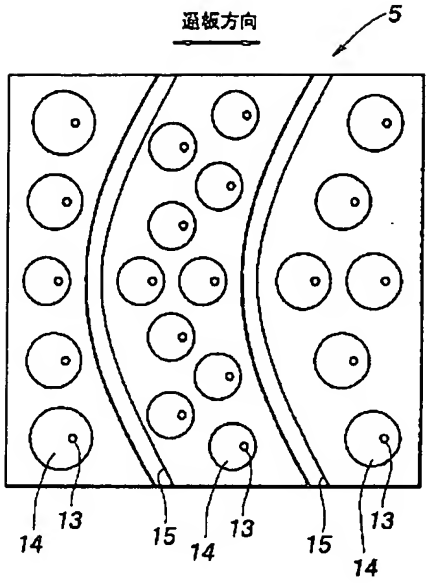
4
F
5
4

【図7】


通板方向
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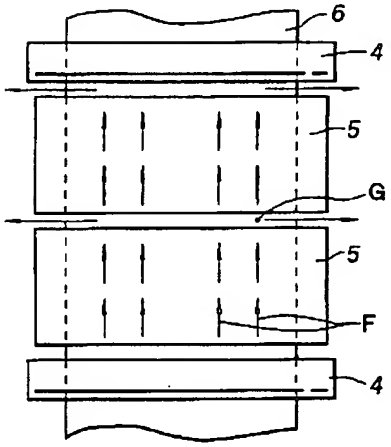
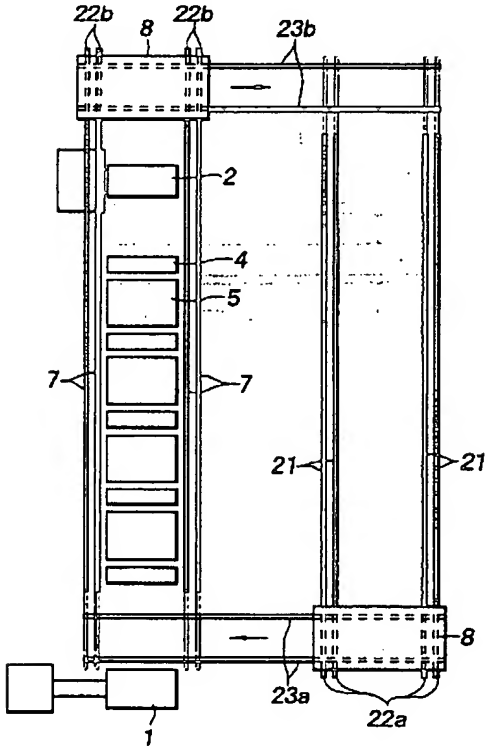
14
13
15
14
13
15
13
14

【図8】


6
4
5
G
5
F
4

【図9】


22b
8
22b
23b
2
4
5
7
7
21
21
8
23a
22a
1

フロントページの続き

(51)Int.Cl.[6]	識別記号	庁内整理番号	F I	技術表示箇所
B21C 47/00			B21C 47/00	H

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CLAIMS

[Claim(s)]
[Claim 1] The band steel rolling facility between heat which has the strip cooling line installed between the finishing mill and coiler which are characterized by providing the following, and the aforementioned finishing mill and the aforementioned coiler. It is the pinch roll which can contact vertical each field of the aforementioned strip after it can shunt on the course of a strip nose-of-cam arresting gear and a strip nose-of-cam arresting gear passes, only while the strip nose-of-cam arresting gear which can move is formed on the aforementioned strip cooling line from the aforementioned finishing-mill side to the aforementioned coiler side synchronizing with rolling speed and the aforementioned strip nose-of-cam arresting gear passes the aforementioned strip cooling line, pinching the nose of cam of a strip and giving tension to a strip. The cooling water fuel injection equipment with which the injection tip was prepared in the field which can approach vertical each field of the aforementioned strip after it can shunt on the course of a strip nose-of-cam arresting gear and a strip nose-of-cam arresting gear passes, only while the aforementioned strip nose-of-cam arresting gear passes.
[Claim 2] The band steel rolling facility between heat according to claim 1 whose sense of the stream of the aforementioned cooling water fuel injection equipment is characterized by meeting in the direction of plate leaping in general.
[Claim 3] The band steel rolling facility between heat according to claim 2 this component is greatly characterized by the bird clapper, including the component the sense of the stream of the aforementioned cooling water fuel injection equipment turns component] to the direction central site of the board width as it goes to the direction outside of the board width.
[Claim 4] The band steel rolling facility between heat given in the claim 1 characterized by preparing the slot which the both sides of the direction of the board width opened wide to the opposed face with the strip of the aforementioned cooling water fuel injection equipment, or any 1 term of 3.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the band steel rolling facility between heat (hot strip mill).
[0002]
[Description of the Prior Art] In the band steel rolling facility between heat, the strip rolled out by the finishing mill even at predetermined board thickness is cooled by even predetermined rolling-up temperature by the strip cooling line prepared between the finishing mill and the down coiler by the time it was rolled round by the mandrel of a down coiler. This strip cooling line consists of a run out table which consists of hundreds of drive formula roller tables, and a water spray formula cooling system or a water lamina formula cooling system, cools the inferior surface of tongue of the strip which has a run-out-table top conveyed with the cooling water injected from between the rollers of a run out table, and cools the upper surface of a strip with the cooling water injected from the upper part of a run out table.
[0003]
[Problem(s) to be Solved by the Invention] By the way, in the case of the water spray formula cooling system like the above, or a water lamina formula cooling system, most cooling water which flowed the upper surface of a strip flows and falls from the side edge of a strip. Therefore, since the side edge section would always touch new water as compared with a center section becoming that the flow of cooling water tends to stagnate, the degree of cooling about the direction of the board width tended to become uneven.
[0004] this invention cancels the trouble imposed on such conventional technology, and is thought out for the purpose of offering the band steel rolling facility between heat improved so that the degree of cooling about the direction of the board width could be equalized.
[0005]
[Means for Solving the Problem] In order to achieve such a purpose, it sets to this invention. In the band steel rolling facility between heat which has the strip cooling line installed between a finishing mill and coiler, and these finishing mills and coiler While forming the strip nose-of-cam arresting gear which can move on a strip cooling line from a finishing-mill side to a coiler side synchronizing with rolling speed, pinching the nose of cam of a strip and giving tension to a strip Only while a strip nose-of-cam arresting gear passes the composition of a strip cooling line, on the course of a strip nose-of-cam arresting gear can be shunted. And the pinch roll which can contact vertical each field of a strip after a strip nose-of-cam arresting gear passes, Only while a strip nose-of-cam arresting gear passes, after it can shunt on the course of a strip nose-of-cam arresting gear and a strip nose-of-cam arresting gear passes, it shall have the cooling water fuel injection equipment with which the injection tip was prepared in the field which can approach vertical each side of a strip.
[0006] And the stream of a cooling water fuel injection equipment is made to meet in the direction of plate leaping in general, and it was made for the component the stream of the injection tip of the direction outside of the board width turns [component] to the direction central site of the board width more nearly especially to become large. Furthermore, the slot which the both sides of the direction of the board width opened wide to the opposed face with the strip of a cooling water fuel injection equipment shall be prepared.
[0007]
[Embodiments of the Invention] With reference to an attached drawing, the composition of this invention is explained in detail below.
[0008] Drawing 1 and drawing 2 show the last stand of the finishing mill 1 in the band steel rolling facility between heat based on this invention, the down coiler 2, and the strip cooling line 3 installed among these. The strip cooling line 3 is the upper and lower sides which opened the proper interval and were installed successively about the direction of plate leaping from the pinch roll 4 and the cooling water fuel injection equipment 5 of a large number which make a pair. These pinch rolls 4 and cooling water fuel injection equipments 5 are arranged by turns about the direction of plate leaping.
[0009] Each pinch roll 4 consists of an up-and-down roll pair, and each roll is supported possible [attachment-and-detachment movement] up and down, respectively. While each pinch roll 4 puts vertical both sides of the strip 6 sent out from a finishing mill 1 with the predetermined press force, each can give driving force and rotational speed is controlled freely. And the cooling water fuel injection equipment 5 consists of a cooling water fuel injection equipment which makes a pair up and down like a pinch roll

4, and each cooling water fuel injection equipment 5 is supported possible [attachment-and-detachment movement to vertical each field of a strip 6]. Two or more cooling water nozzles are prepared in the opposed face with the strip 6 of this cooling water fuel injection equipment 5, and cooling water can be blown now upon vertical each field of a strip 6.

[0010] The guide rail 7 is installed in the strip cooling line 3 along the direction of plate leaping. The strip nose-of-cam arresting gear 8 it runs where the nose of cam of the strip 6 sent out from a finishing mill 1 is grasped is laid in this guide rail 7. The strip nose-of-cam arresting gear 8 is equipped with the run truck 9 driven by the pinion gear which gears on the rack gear installed in a guide rail and parallel, for example, and the grasping roll 10 which grasps the nose of cam of the strip 6 sent out from a finishing mill 1 from the upper and lower sides while a wheel is regulated by the up-and-down guide rail 7 and a relief is prevented.

[0011] The opposed face with a strip 6 is making the flat surface, and the aforementioned cooling water fuel injection equipment 5 is carrying out opening of the cooling water nozzle 13 into the hollow 14 cut in this flat surface, as shown in drawing 3 and drawing 4 . [many] And the more nearly outside thing is turned to the central site of the direction of the board width as the sense of all streams is arranged in parallel in the direction of either the upstream of the sending-out direction of a strip 6, or a downstream as the injection direction of the cooling water nozzle 13 meets in the direction of plate leaping in general and Arrow F showed to drawing 5 , or Arrow F showed as well as drawing 6 . By giving greatly the component the stream of an outside nozzle turns [component] to the inside of a board, without making the stream F of all nozzles especially parallel to the direction of plate leaping, it suppresses that cooling water flows out of the side edge of a strip 6 at an early stage, and only the side edge section of a strip 6 touches new water, and can prevent supercooling and a bird clapper.

[0012] The slot 15 which meets in the direction of the board width is cut in the opposed face with the strip 6 of the cooling water fuel injection equipment 5. the ** to which the new water spouted from each cooling water nozzle 13 does not interfere in the grasping roll 10 by this slot 15 -- an early stage -- and since it is discharged on the average, it becomes possible to increase the flow rate of cooling water, and the cooling rate of a strip 6 can be raised Further by this, the inclination about the direction of the board width of the cooling water pressure between the cooling water fuel injection equipment 5 and a strip 6 can be eased, the flow of the direction of the board width in a portion with high cooling water pressure other than slot 15 can be suppressed, and generating of the cooling unevenness of the direction of the board width can be prevented. In addition, this slot 15 may curve suitably, as shown not only in a thing linear in the direction of the board width but in drawing 7 . Moreover, even if it makes small the division unit about the direction of plate leaping of the cooling water fuel injection equipment 5, it opens the proper crevice G between each division unit and it makes it drain from this crevice G ** [according to / such a slot 15] as shown in drawing 8 , it is effective for raising a cooling rate and abolishing cooling unevenness. In addition, it may be the problem of the stream balance of each section divided in short also about arrangement of the cooling water nozzle 13 in the slot 15, and you may be arrangement not only a regular array but random.

[0013] Next, the operation point of the above-mentioned example is explained.

[0014] In the state before sending out the nose of cam of a strip 6 from a finishing mill 1, as shown in drawing 1 , all the pinch rolls 4 and all the cooling water fuel injection equipments 5 move to the position estranged up and down mutually, and it is standing by. And the strip nose-of-cam arresting gear 8 is standing by, where the grasping roll 10 is rotated with mist or a high peripheral velocity from the sending-out speed of the strip 6 from a finishing mill 1 at the latest of the outlet of the last stand of a finishing mill 1.

[0015] Shortly after the nose of cam of a strip 6 comes out of a finishing mill 1, the strip nose-of-cam arresting gear 8 grasps the nose of cam of a strip 6 between the grasping rolls 10 of a couple. With it almost, or rather, what minute, the strip nose-of-cam arresting gear 8 starts the acceleration which goes to a down coiler 2, and comes to run acceleration a little early for a short time synchronizing with the rolling speed of a finishing mill 1.

[0016] On the other hand, each set of the pinch roll 4 which had shunted in vertical both directions, and the cooling water fuel injection equipment 5 moves so that it may take to passage of the strip nose-of-cam arresting gear 8 and vertical each field of a strip 6 may be approached in order. And the rotational speed is controlled for a pinch roll 4 to contact vertical each side of a strip 6, and to always maintain the tension of a strip 6 in the predetermined range. Moreover, from the cooling water fuel injection equipment 5, cooling water is blown towards vertical each side of a strip 6. Thus, since a strip 6 is cooled where always suitable tension is given, the board configuration after cooling is improved sharply. And since attachment-and-detachment movement is possible also for the cooling water fuel injection equipment 5 to the front face of a strip 6, the cooling water fuel injection equipment 5 can be made to be able to approach the front face of a strip 6 after passage of the strip nose-of-cam arresting gear 8 and water pressure can be applied and cooled quickly all over a strip, cooling line length can be cut down. In addition, since scale ** generated on the front face of a strip 6 becomes small, the load of the acid cleaning of the following process is mitigated.

[0017] If the nose of cam of a strip 6 arrives at the entrance of a down coiler 2, the retention span of the grasping roll 10 of the strip nose-of-cam arresting gear 8 will be released. Thereby, the strip nose-of-cam arresting gear 8 separates from a strip 6, to the termination of a guide rail 7, runs as it is and stops.

[0018] On the other hand, near the entrance of a down coiler 2, as shown in drawing 2 , the fluid fuel injection equipment 11 for introducing the nose of cam of a strip 6 to a down coiler 2 is formed. From this fluid fuel injection equipment 11, the water pressurized towards the point of the strip 6 which became free, air, nitrogen gas, etc. are sprayed, and the nose of cam of a strip 6 is led to the entrance of a down coiler 2 at the same time a strip 6 is separated from the strip nose-of-cam arresting gear 8. At this time, the inflow of the strip 6 to the entrance of a down coiler 2 can be further carried out smoothly by giving the velocity component of the travelling direction of a strip 6 to an injection fluid.

[0019] In addition, in case a strip 6 is rolled round by the mandrel of a down coiler 2, by always adding the back tension to a strip

6 by the pinch roll 4, a strip 6 slackens and is rolled round uniformly [there is nothing and]. Since the slowdown of the strip 6 on the strip cooling line 3 is attained, it becomes unnecessary therefore, to slow down the rolling speed of a strip tail edge in a finishing mill 1.

[0020] the electromagnetism built in each cooling water fuel injection equipment 5 located in the bottom although there was a possibility that the restraint to a tail edge might sway in case the tail edge of a strip 6 passes a pinch roll 4, and a tail edge might sway up and down to a ******** sake -- a stable run of a tail edge is maintained by the aspirator 12 Since a tail edge can be stabilized with the injection pressure from the fluid fuel injection equipment 11 when a tail edge reaches a down coiler 2, it becomes unnecessary and to slow down the bearer rate of a strip tail edge sharply.

[0021] By the way, by returning the strip nose-of-cam arresting gear 8 to the position just behind a finishing mill 1 in preparation for sending out of the following strip, if one coil finishes winding, if it is ****, although there is nothing, this reset time will serve as lost time. In order to make it this lost time not arise Return in parallel [as shown in drawing 9] with the guide rail 7 prepared in the strip cooling line 3, and the guide rail 21 of exclusive use is formed. While carrying out as [connect / shorter-rail 22a and 22b which is the grade by which the strip nose-of-cam arresting gear 8 appears in each of the leader of these 2 sets of guide rails 7-21 and a trailer] It is good for this shorter-rail 22a and 22b to prepare infestation rail 23a and 23b so that horizontal movement right and left may be free, and to be made to carry out horizontal movement of two sets of the strip nose-of-cam arresting gears 8 by turns with shorter-rail 22a and 22b. If it does in this way, while one strip nose-of-cam arresting gear will run the guide-rail 7 top Return the strip nose-of-cam arresting gear of another side, and make it run the guide-rail 21 top of exclusive use, and it returns to a finishing-mill 1 side. When it finishes rolling a coil and a pinch roll 4 and the cooling water fuel injection equipment 5 are opened up and down Carry out horizontal movement and the guide rail 7 of the strip cooling line 3 is made to adjust the strip nose-of-cam arresting gear of another side which has already returned to the start edge side with shorter-rail 22a by the side of the start edge. And since horizontal movement can be carried out, a strip nose-of-cam arresting gear can be returned and while running to the termination of the strip cooling line 3 can make the guide rail 21 of exclusive use adjust it with shorter-rail 22b by the side of termination The standby state over sending out of the following strip can be realized without producing lost time.

[0022]

[Effect of the Invention] Thus, since cooling efficiency may be improved by being able to give fixed tension to a strip and moreover making a cooling water fuel injection equipment approach a strip at the time of cooling, since the strip nose-of-cam arresting gear restrained mechanically runs the nose of cam of the strip sent out from a finishing mill synchronizing with the rolling speed of a finishing mill according to this invention, a cooling state will be equalized over the overall length of a strip. Therefore, upgrading of a strip can be attained. And since generating of a premature start or meandering can be prevented over the overall length of a strip and plate-leaping speed is accelerable corresponding to the capacity of a finishing mill, improvement in productivity can also be attained.

[Translation done.]

* NOTICES *

TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the band steel rolling facility between heat (hot strip mill).

[Translation done.]

* NOTICES *

PRIOR ART

[Description of the Prior Art] In the band steel rolling facility between heat, the strip rolled out by the finishing mill even at predetermined board thickness is cooled by even predetermined rolling-up temperature by the strip cooling line prepared between the finishing mill and the down coiler by the time it was rolled round by the mandrel of a down coiler. This strip cooling line consists of a run out table which consists of hundreds of drive formula roller tables, and a water spray formula cooling system or a water lamina formula cooling system, cools the inferior surface of tongue of the strip which has a run-out-table top conveyed with the cooling water injected from between the rollers of a run out table, and cools the upper surface of a strip with the cooling water injected from the upper part of a run out table.

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EFFECT OF THE INVENTION

[Effect of the Invention] Thus, since cooling efficiency may be improved by being able to give fixed tension to a strip and moreover making a cooling water fuel injection equipment approach a strip at the time of cooling, since the strip nose-of-cam arresting gear restrained mechanically runs the nose of cam of the strip sent out from a finishing mill synchronizing with the rolling speed of a finishing mill according to this invention, a cooling state will be equalized over the overall length of a strip. Therefore, upgrading of a strip can be attained. And since generating of a premature start or meandering can be prevented over the overall length of a strip and plate-leaping speed is accelerable corresponding to the capacity of a finishing mill, improvement in productivity can also be attained.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, in the case of the water spray formula cooling system like the above, or a water lamina formula cooling system, most cooling water which flowed the upper surface of a strip flows and falls from the side edge of a strip. Therefore, since the side edge section would always touch new water as compared with a center section becoming that the flow of cooling water tends to stagnate, the degree of cooling about the direction of the board width tended to become uneven.

[0004] this invention cancels the trouble imposed on such conventional technology, and is thought out for the purpose of offering the band steel rolling facility between heat improved so that the degree of cooling about the direction of the board width could be equalized.

[Translation done.]

MEANS

[Means for Solving the Problem] In order to achieve such a purpose, it sets to this invention. In the band steel rolling facility between heat which has the strip cooling line installed between a finishing mill and coiler, and these finishing mills and coiler While forming the strip nose-of-cam arresting gear which can move on a strip cooling line from a finishing-mill side to a coiler side synchronizing with rolling speed, pinching the nose of cam of a strip and giving tension to a strip Only while a strip nose-of-cam arresting gear passes the composition of a strip cooling line, on the course of a strip nose-of-cam arresting gear can be shunted. And the pinch roll which can contact vertical each field of a strip after a strip nose-of-cam arresting gear passes, Only while a strip nose-of-cam arresting gear passes, after it can shunt on the course of a strip nose-of-cam arresting gear and a strip nose-of-cam arresting gear passes, it shall have the cooling water fuel injection equipment with which the injection tip was prepared in the field which can approach vertical each side of a strip.
[0006] And the stream of a cooling water fuel injection equipment is made to meet in the direction of plate leaping in general, and it was made for the component the stream of the injection tip of the direction outside of the board width turns [component] to the direction central site of the board width more nearly especially to become large. Furthermore, the slot which the both sides of the direction of the board width opened wide to the opposed face with the strip of a cooling water fuel injection equipment shall be prepared.
[0007]
[Embodiments of the Invention] With reference to an attached drawing, the composition of this invention is explained in detail below.
[0008] Drawing 1 and drawing 2 show the last stand of the finishing mill 1 in the band steel rolling facility between heat based on this invention, the down coiler 2, and the strip cooling line 3 installed among these. The strip cooling line 3 is the upper and lower sides which opened the proper interval and were installed successively about the direction of plate leaping from the pinch roll 4 and the cooling water fuel injection equipment 5 of a large number which make a pair. These pinch rolls 4 and cooling water fuel injection equipments 5 are arranged by turns about the direction of plate leaping.
[0009] Each pinch roll 4 consists of an up-and-down roll pair, and each roll is supported possible [attachment-and-detachment movement] up and down, respectively. While each pinch roll 4 puts vertical both sides of the strip 6 sent out from a finishing mill 1 with the predetermined press force, each can give driving force and rotational speed is controlled freely. And the cooling water fuel injection equipment 5 consists of a cooling water fuel injection equipment which makes a pair up and down like a pinch roll 4, and each cooling water fuel injection equipment 5 is supported possible [attachment-and-detachment movement to vertical each field of a strip 6]. Two or more cooling water nozzles are prepared in the opposed face with the strip 6 of this cooling water fuel injection equipment 5, and cooling water can be blown now upon vertical each field of a strip 6.
[0010] The guide rail 7 is installed in the strip cooling line 3 along the direction of plate leaping. The strip nose-of-cam arresting gear 8 it runs where the nose of cam of the strip 6 sent out from a finishing mill 1 is grasped is laid in this guide rail 7. The strip nose-of-cam arresting gear 8 is equipped with the run truck 9 driven by the pinion gear which gears on the rack gear installed in a guide rail and parallel, for example, and the grasping roll 10 which grasps the nose of cam of the strip 6 sent out from a finishing mill 1 from the upper and lower sides while a wheel is regulated by the up-and-down guide rail 7 and a relief is prevented.
[0011] The opposed face with a strip 6 is making the flat surface, and the aforementioned cooling water fuel injection equipment 5 is carrying out opening of the cooling water nozzle 13 into the hollow 14 cut in this flat surface, as shown in drawing 3 and drawing 4 . [many] And the more nearly outside thing is turned to the central site of the direction of the board width as the sense of all streams is arranged in parallel in the direction of either the upstream of the sending-out direction of a strip 6, or a downstream as the injection direction of the cooling water nozzle 13 meets in the direction of plate leaping in general and Arrow F showed to drawing 5 , or Arrow F showed as well as drawing 6 . By giving greatly the component the stream of an outside nozzle turns [component] to the inside of a board, without making the stream F of all nozzles especially parallel to the direction of plate leaping, it suppresses that cooling water flows out of the side edge of a strip 6 at an early stage, and only the side edge section of a strip 6 touches new water, and can prevent supercooling and a bird clapper.
[0012] The slot 15 which meets in the direction of the board width is cut in the opposed face with the strip 6 of the cooling water fuel injection equipment 5. the ** to which the new water spouted from each cooling water nozzle 13 does not interfere in the grasping roll 10 by this slot 15 -- an early stage -- and since it is discharged on the average, it becomes possible to increase the flow rate of cooling water, and the cooling rate of a strip 6 can be raised Further by this, the inclination about the direction of the board width of the cooling water pressure between the cooling water fuel injection equipment 5 and a strip 6 can be eased, the

flow of the direction of the board width in a portion with high cooling water pressure other than slot 15 can be suppressed, and generating of the cooling unevenness of the direction of the board width can be prevented. In addition, this slot 15 may curve suitably, as shown not only in a thing linear in the direction of the board width but in drawing 7 . Moreover, even if it makes small the division unit about the direction of plate leaping of the cooling water fuel injection equipment 5, it opens the proper crevice G between each division unit and it makes it drain from this crevice G ** [according to / such a slot 15] as shown in drawing 8 , it is effective for raising a cooling rate and abolishing cooling unevenness. In addition, it may be the problem of the stream balance of each section divided in short also about arrangement of the cooling water nozzle 13 in the slot 15, and you may be arrangement not only a regular array but random.

[0013] Next, the operation point of the above-mentioned example is explained.

[0014] In the state before sending out the nose of cam of a strip 6 from a finishing mill 1, as shown in drawing 1 , all the pinch rolls 4 and all the cooling water fuel injection equipments 5 move to the position estranged up and down mutually, and it is standing by. And the strip nose-of-cam arresting gear 8 is standing by, where the grasping roll 10 is rotated with mist or a high peripheral velocity from the sending-out speed of the strip 6 from a finishing mill 1 at the latest of the outlet of the last stand of a finishing mill 1.

[0015] Shortly after the nose of cam of a strip 6 comes out of a finishing mill 1, the strip nose-of-cam arresting gear 8 grasps the nose of cam of a strip 6 between the grasping rolls 10 of a couple. With it almost, or rather, what minute, the strip nose-of-cam arresting gear 8 starts the acceleration which goes to a down coiler 2, and comes to run acceleration a little early for a short time synchronizing with the rolling speed of a finishing mill 1.

[0016] On the other hand, each set of the pinch roll 4 which had shunted in vertical both directions, and the cooling water fuel injection equipment 5 moves so that it may take to passage of the strip nose-of-cam arresting gear 8 and vertical each field of a strip 6 may be approached in order. And the rotational speed is controlled for a pinch roll 4 to contact vertical each side of a strip 6, and to always maintain the tension of a strip 6 in the predetermined range. Moreover, from the cooling water fuel injection equipment 5, cooling water is blown towards vertical each side of a strip 6. Thus, since a strip 6 is cooled where always suitable tension is given, the board configuration after cooling is improved sharply. And since attachment-and-detachment movement is possible also for the cooling water fuel injection equipment 5 to the front face of a strip 6, the cooling water fuel injection equipment 5 can be made to be able to approach the front face of a strip 6 after passage of the strip nose-of-cam arresting gear 8 and water pressure can be applied and cooled quickly all over a strip, cooling line length can be cut down. In addition, since scale ** generated on the front face of a strip 6 becomes small, the load of the acid cleaning of the following process is mitigated.

[0017] If the nose of cam of a strip 6 arrives at the entrance of a down coiler 2, the retention span of the grasping roll 10 of the strip nose-of-cam arresting gear 8 will be released. Thereby, the strip nose-of-cam arresting gear 8 separates from a strip 6, to the termination of a guide rail 7, runs as it is and stops.

[0018] On the other hand, near the entrance of a down coiler 2, as shown in drawing 2 , the fluid fuel injection equipment 11 for introducing the nose of cam of a strip 6 to a down coiler 2 is formed. From this fluid fuel injection equipment 11, the water pressurized towards the point of the strip 6 which became free, air, nitrogen gas, etc. are sprayed, and the nose of cam of a strip 6 is led to the entrance of a down coiler 2 at the same time a strip 6 is separated from the strip nose-of-cam arresting gear 8. At this time, the inflow of the strip 6 to the entrance of a down coiler 2 can be further carried out smoothly by giving the velocity compornent of the travelling direction of a strip 6 to an injection fluid.

[0019] In addition, in case a strip 6 is rolled round by the mandrel of a down coiler 2, by always adding the back tension to a strip 6 by the pinch roll 4, a strip 6 slackens and is rolled round uniformly [there is nothing and]. Since the slowdown of the strip 6 on the strip cooling line 3 is attained, it becomes unnecessary therefore, to slow down the rolling speed of a strip tail edge in a finishing mill 1.

[0020] the electromagnetism built in each cooling water fuel injection equipment 5 located in the bottom although there was a possibility that the restraint to a tail edge might sway in case the tail edge of a strip 6 passes a pinch roll 4, and a tail edge might sway up and down to a ******** sake -- a stable run of a tail edge is maintained by the aspirator 12 Since a tail edge can be stabilized with the injection pressure from the fluid fuel injection equipment 11 when a tail edge reaches a down coiler 2, it becomes unnecessary and to slow down the bearer rate of a strip tail edge sharply.

[0021] By the way, by returning the strip nose-of-cam arresting gear 8 to the position just behind a finishing mill 1 in preparation for sending out of the following strip, if one coil finishes winding, if it is ****, although there is nothing, this reset time will serve as lost time. In order to make it this lost time not arise Return in parallel [as shown in drawing 9] with the guide rail 7 prepared in the strip cooling line 3, and the guide rail 21 of exclusive use is formed. While carrying out as [connect / shorter-rail 22a and 22b which is the grade by which the strip nose-of-cam arresting gear 8 appears in each of the leader of these 2 sets of guide rails 7-21 and a trailer] It is good for this shorter-rail 22a and 22b to prepare infestation rail 23a and 23b so that horizontal movement right and left may be free, and to be made to carry out horizontal movement of two sets of the strip nose-of-cam arresting gears 8 by turns with shorter-rail 22a and 22b. If it does in this way, while one strip nose-of-cam arresting gear will run the guide-rail 7 top Return the strip nose-of-cam arresting gear of another side, and make it run the guide-rail 21 top of exclusive use, and it returns to a finishing-mill 1 side. When it finishes rolling a coil and a pinch roll 4 and the cooling water fuel injection equipment 5 are opened up and down Carry out horizontal movement and the guide rail 7 of the strip cooling line 3 is made to adjust the strip nose-of-cam arresting gear of another side which has already returned to the start edge side with shorter-rail 22a by the side of the start edge. And since horizontal movement can be carried out, a strip nose-of-cam arresting gear can be returned and while running to the termination of the strip cooling line 3 can make the guide rail 21 of exclusive use adjust it with shorter-rail 22b by

the side of termination The standby state over sending out of the following strip can be realized without producing lost time.
[0022]

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The notional block diagram showing the state before carrying out plate leaping of the strip to the strip cooling line in this invention facility.
[Drawing 2] The notional block diagram showing the state where plate leaping of the strip was carried out to the strip cooling line in this invention facility.
[Drawing 3] The outline plan showing an example of an opposed face with the strip of a cooling water fuel injection equipment.
[Drawing 4] The partial cross section of a cooling water fuel injection equipment.
[Drawing 5] The notional plan showing an example of the relation between the direction of plate leaping, and a stream.
[Drawing 6] The notional plan showing example of another of the relation between the direction of plate leaping, and a stream.
[Drawing 7] The outline plan showing example of another of an opposed face with the strip of a cooling water fuel injection equipment.
[Drawing 8] The notional plan showing another example of composition of a cooling water fuel injection equipment.
[Drawing 9] The plot plan of the guide rail of a strip nose-of-cam arresting gear.
[Description of Notations]
1 Finishing Mill
2 Down Coiler
3 Strip Cooling Line
4 Pinch Roll
5 Cooling Water Fuel Injection Equipment
6 Strip
7 Guide Rail
8 Strip Nose-of-Cam Arresting Gear
9 Run Truck
10 Grasping Roll
11 Fluid Fuel Injection Equipment
12 Electromagnetism -- Aspirator
21 Guide Rail Only for Return
22aand22b Shorter rail
23aand23b Infestation rail

[Translation done.]